

Series 1 – Agriculture and Livestock – Innovative, Commercially- oriented and Modern Agriculture and Livestock Sector

Investment in Technologies: Key Strategy for Postharvest Loss Reduction

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Key Messages

The government is supporting smallholder producers to form commodity associations and producer business groups to facilitate production and marketing. Smallholder farmers lack access to requisite technologies to aggregate and process high-quality products that meet the target markets' standards. Investment in postharvest technologies is viable when many adopted by farmers or farmer groups and discount rates are low. There is a need to promote proven low-cost innovative postharvest technologies to ensure market access and reduce postharvest losses.

*Images Source: Authors
Tunnel Solar Dryer*

Context

The horticultural sector befits smallholder farmers due to low land and labour requirements. In Kenya, mango is one of the major fruits, second only to banana (HCDA, 2017). Kenya exports a paltry 2% and less than 10% is processed. The consistent increase in mango production has been coupled with an increase in postharvest losses (PHL) estimated at 40-50% (KARI, 2004). Concerted efforts and commitments to reduce PHL exist. Under the Sustainable Development Goal 12.3 and the African Union's Malabo Declaration of 2014, there is a commitment to halve postharvest losses from the 2015 levels by the year 2030 and 2025, respectively. Apart from increasing food reserves, elimination of PHL in fruits alone could raise domestic horticultural revenue by 17%, pitching the fruit sub-sector ahead of the vegetable and floriculture sub-sectors that are currently the highest revenue earners in the horticultural sector.

Historically, horticultural research has focused on increasing productivity. However, given the inelasticity of scarce resources, there is a consensus that the focus should shift to PHL reduction. The high postharvest losses occur due to poor postharvest handling, lack of storage technologies, lack of processing facilities, and poor market access. Developing cold chains is critical in PHL

reduction in horticulture. However, conventional cold storage facilities required for proper cold chains are expensive and not applicable in most rural areas due to lack of electricity. Most households (>80%) in rural Kenya have no access to electricity making it untenable and costly to invest in cold storage facilities (GoK, 2008; Shitanda et al., 2011).

Consequently, the lack of cold storage facilities to aggregate the perishable produce and negotiate for better prices predisposes the smallholders to exploitation by middlemen. Globally, applicable off-grid cold storage and processing technologies exist. However, their adoption in Kenya is limited due to a lack of awareness and demonstrated benefits. It is against this background, that the University of Nairobi's postharvest project, with support from the Rockefeller Foundation's YieldWise Initiative, sought to upgrade two fruit aggregation centres. Low-cost technologies including zero-energy brick coolers, evaporative charcoal coolers, and tunnel solar dryers were provided to create awareness and demonstrate their practical application. However, little is known about their economic impact in Kenya, hence this study.

Approach and Results

The return on investment (ROI) for the PH technologies was estimated using Cost-Benefit Analysis. The cost of implementation of the technology by



farmers was estimated from the cost of experiments that were set up in the study area. Embu County was purposively selected since an earlier project (YieldWise) had been implemented there to ensure proper agronomic practices to reduce preharvest losses. Extension activities enhance knowledge of the technologies among the farmers. The annual cost of extension was also estimated.

The economic surplus model was employed to estimate the potential benefits of investing in PH technologies to both producers and consumers. The economic surplus model measures the total gain in economic welfare (change in total surplus) and is a function of the gains to both producers and consumers due to the expected increase in supply owing to technological advancement. The total gain in economic welfare is a function of the elasticity of supply and demand, yield, price, cost of current postharvest management practices/interventions, expected yield increases, success rate, and the depreciation rate. The relevant data were collected from a household survey in Embu, secondary data, and expert opinion which was sought from researchers, scientists and extensionists.



Figure 1 - Mango fruits stored in a Charcoal Cooler



Figure 2 - Mango fruits stored in zero-energy brick cooler



Figure 3 - Mango fruits processed in a tunnel solar dryer

Results and Conclusions

Producers are willing to pay for postharvest technologies. Results revealed that 81%, 56%, and 51% of the farmers were willing to pay for charcoal coolers, brick coolers, and tunnel solar driers, respectively. Most respondents (80%) expressed a willingness to pay for more affordable charcoal coolers. About half of the respondents expressed willingness to pay for brick coolers, and tunnel solar driers.

Investing in postharvest technologies is worthwhile. The Net Present Value (NPV) of the research was US\$ 1.29 billion, with an Internal Rate of Return (IRR) of 28% and a Benefit-Cost Ratio (BCR) of 4:1. The positive NPV implies that the proposed investment has fairly attractive returns given the cautious assumption made on the annual 1% adoption rate and a maximum adoption rate of 10% in 10 years. The estimated IRR exceeded the market rate of 10% implying that investing in the PH technologies has the potential of yielding higher returns than investing the same capital on alternative investments. A BCR of 4:1 means that the investor can expect \$4 in benefits for every \$1 in cost. Producers are expected to gain from the higher marketable produce resulting from both the saved fruit and the existence of advanced postharvest technologies for storage and processing. Consumers are expected to gain from lower produce prices due to an increase in supply.

Policy Recommendations

Short-Term

- There is a need for concerted efforts to create awareness and promote low-cost cold storage and small-scale processing PH technologies. Returns to investment in PH technologies highly depend on adoption decisions by the farmers.
- The profitability of PH technologies is higher at lower interest rates. Thus there is a need to stabilize interest rates
- Short term price subsidies and/or tax exemption on fabrication materials are recommended for the zero energy brick coolers and tunnel solar driers that are more efficient but expensive and which fewer farmers were willing to pay for.

Medium-Term

- Enhance capacity building in postharvest management at all levels including farmers, traders, extension agents, agricultural training institutions
- Support adaptive research and innovation in locally feasible and

affordable postharvest management options

- Maintain the cost of capital at affordable rates
- Develop and implement policies that incentivize postharvest technology adoption by various value chain actors including farmers, transporters and traders
- Promote the consumption and export of dried fruit and vegetable products to create demand thereby increasing returns on investment in the technologies

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